7 | Technology Overview

This section provides a summary of technology available in the current parking industry. The majority of this section focuses on on-street payment technologies, including Pay-by-Space Meters, Pay-and-Display Meters, Credit Card Capable Single Space Meters, Pay-by-License Plate Meters, Pay-by-Cell, and other smart phone applications. The latter portion of this section provides an overview of electric vehicle charging stations.

On-Street Payment Technology

As part of this study, paid on-street parking is a recommendation for implementation within certain areas of Downtown Durham to encourage turnover of on-street spaces and higher utilization of off-street facilities, as well as a revenue generator to support the operations and management of the parking system. As a result, on-street payment technology types were investigated and a description of each is included below.

Pay-By-Space

Pay-By-Space is a multi-space meter operational methodology that has grown in popularity recently. The user interface is initially more complicated, but has definite advantages that need to be considered when assessing multi-space meter selection and implementation.

This methodology first started in the off-street lots as a replacement option for manual "slot box" systems. These simple "slot box" systems allowed motorists to note the space number where they parked their vehicle, go to the "pay box or honor box," and slip in the proper payment for the amount of time desired into the slot that corresponded to the space number. This allowed the lot to be minimally monitored by the parking operator. Once the electronic version of the honor box was developed (the Pay-By-Space meter) this methodology then migrated to on-street parking where it has grown in popularity.

The basic premise of the Pay-By-Space methodology is that the motorist parks in a space, notes the space number, and proceeds to the closest multi-space meter located near their vehicle. In an on-street application, there are usually one or two machines per block face.

The motorist operates the multi-space meter as directed by the manufacturer's instructions. Some of the newer meters have instructions right on their digital displays, giving the motorists step-by-step instructions on how to pay for their parking. They also may offer various options at the time of purchase such as the ability to add time or use coupons or special payment cards or codes. The motorist then takes their receipt and continues onto their destination (without having to return to their vehicle to display the receipt).

If all the Pay-By-Space machines are networked, the motorist could actually add more time for their space number at any meter (not just the one on the block face where they parked) as long as they did not exceed the time limit that applied to their

space. The amount of additional time allowed can be assigned on a space-by-space basis as defined in the parking policy rules of the governing agency.

Another important element of a Pay-By-Space system is the need to number each space. Some argue that this requirement defeats the use of multi-space meters to "declutter" the streetscape.

In some southern environments with warmer climates space numbering can be accomplished by painting space numbers on the pavement or curbs. However, in northern cities with significant snow accumulation, pole mounted signs are a requirement.

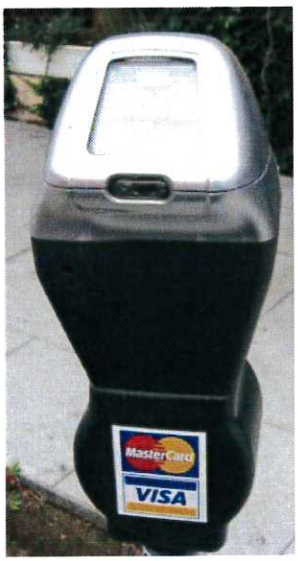
Pay-And-Display

The Pay-and-Display system has the greatest portion of market share in the U.S. partly because it was the first model introduced after individual meters. The motorist parks, then walks to a multi-space meter operating in Pay-and-Display mode. The motorist pays for the desired duration of parking using coin, cash, credit, or smart card and receives a receipt for payment. The parking patron then returns to their vehicle and displays the receipt on the dashboard with the expiration time visible. The displayed receipt proves to the enforcement staff that the space has indeed been paid for through the time printed on the displayed receipt.

There are several reasons for the more widespread application of Pay-and-Display systems:

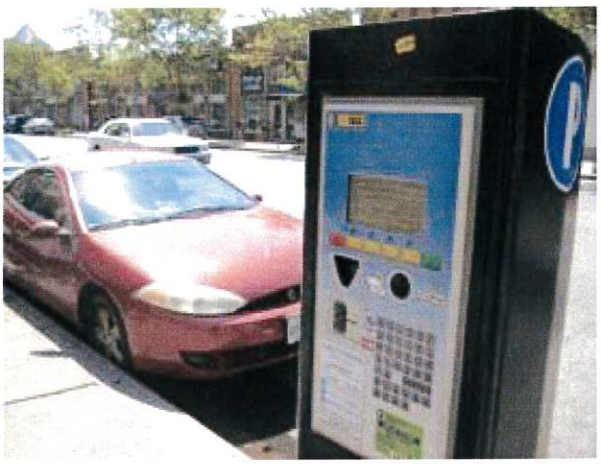
- Pay-and-Display has been in use longer than Pay-By-Space.
- Europe uses Pay-and-Display almost exclusively and only recently have they even considered Pay-By-Space.
- Pay-and-Display is favored for areas that have significant snowfall in the winter. This is because it is more problematic to keep space numbers visible (a requirement for the Pay-By-Space methodology) with snow or ice on the ground. There also are potential problems with snow removal tools accidently causing damage, to the numbers used in a Pay-By-Space system, as well as vandalism.
- Pay-and-Display is a simpler technology to manage as an owner and use as a patron.

Credit Card Capable Single Space Meters



A viable alternative to multi-space meters that provides many of the primary benefits (regarding improved customer payment options, ease of use, and back-end software support) is credit card capable single space meters. The main detractor to single space meters is the quantity that is required to be installed, resulting in some cases in a "cluttered" look to the streetscape and crowding of sidewalks. Currently, only a few vendors provide the option to retrofit current single space meter housing with an electronic mechanism that can perform on-line credit card transactions as well as continued acceptance of coin, smart card, and cell phone payments. Credit card capable single space meters need to meet the Payment Card Industry (PCI) security standards. Credit card transactions are encrypted and authorized, and only the last four digits of each credit card number are stored within the meters for security purposes.

Pay-by-License Plate



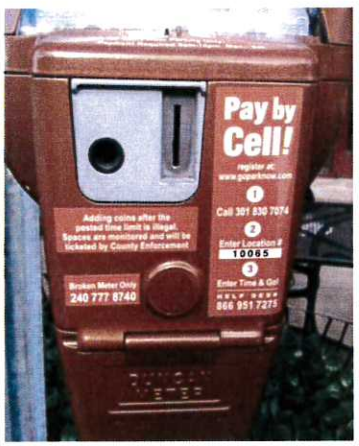
Pay-by-license plate is an operating methodology that has been brought from Europe to the U.S. and Canada. Rather than using space numbers, this operating method requires motorists to pay for parking by entering their license plate number (as well as parking zone, if applicable) into a multi-space meter or cell phone payment system.

While this works well in Europe, this methodology has been slower to take hold in the U.S. due to U.S. license plate numbers. Europe uses a standard license plate with straight-line numbers assigned by country. Europe does not allow vanity plates or special characters. In the U.S. the numbering systems varies by state with special plates, vanity plates, special characters and other items that complicate the entering of the number. The success of the system will be contingent upon motorists remembering their own specific license numbers and the ability of the system to accept specialized information.

Below are the fundamental steps in the pay-by-license plate/zone process:

- Vehicle parks in a zoned area
  - Each metered space is located within a zone, with signage indicating zone numbering
  - The motorist uses multi-space meter or Pay-by-Phone option for payment
  - The motorist enters zone and license plate information
  - The motorist pays applicable parking rate
- License plate and payment information stored in a real-time database
  - License Plate Recognition (LPR) equipped vehicle patrols zones
  - LPR Patrol takes digitized picture of parked vehicle's license plate
- LPR Patrol Communicates with system database
  - Database informs LPR Patrol of vehicle's payment status
  - If expired, a violation with photo, is processed and mailed to the vehicle owner
  - LPR Patrol continues route enforcement

Pay-by-Cell Phone



The Pay-by-Cell Phone is just as it sounds. Once the motorist has parked their vehicle, they then call a phone number, usually located on a sign or the parking meter, enter the space number they're parked in and then hang up. There is an initial, one-time set-up where a credit card number is matched with a phone number. After the initial setup, the system then uses caller ID to match the user with the account or another type of account ID.

Pay-by-Cell Phone has been in use for a few years, however, the latest utilization numbers indicate that only 3% of those parking in a location that supports this

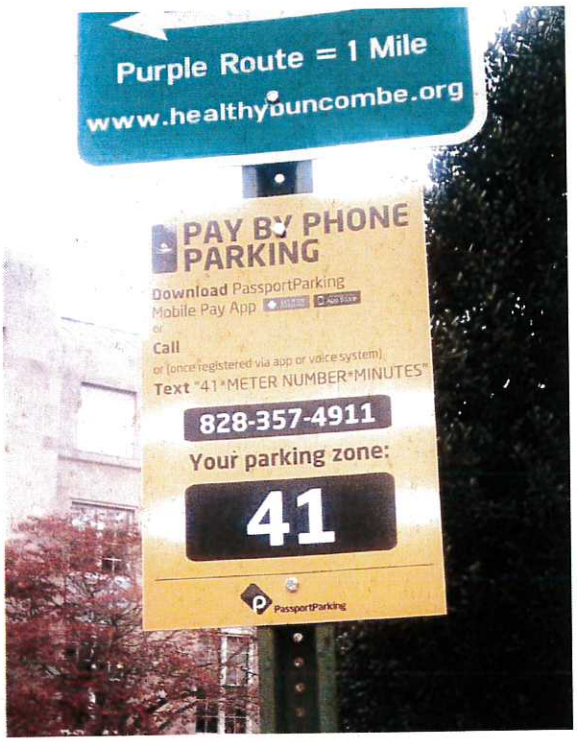
technology use it on a regular basis. However, many parking professionals see this as the parking technology with the great potential going forward.

The big advantage of this type of system is the ability to add time remotely from your cell phone, especially in commuter lots. If the motorist, who planned to stay half an hour, decides to extend their trip for additional shopping or dining, they can call the number provided and add time to their parking to avoid a violation. Once the customer has paid for the maximum time allowed (per posted time limits) adding more time is not allowed.

Smart Phone Applications

Similar to the pay-by-cell phone methodology described previously, the motorist is able to find and pay for their parking transaction using a smart phone application. This technology is relatively new, and is currently in limited markets. The motorist must download the application to their Smart Phone. The application could either be free or cost a nominal purchase fee (usually less than $5.00).

Most applications require the motorist to register online or through their phone prior to the first usage. The motorist will have to store a credit card on file, just like the pay-by-cell phone system. After initial registration, the motorist locates a parking meter, opens the application, and then pays for their transaction.



Some of the newer applications not only allow you to pay for parking, they also help you locate available parking. One of the early methods of this premise relied solely on its network of application users. For example, users of OpenSpot, developed by Google, could use the application not only to find parking, but also to notify other application users of available parking. The methodology included opening the application and indicating that you had left a spot, which notified other users of the space, and gave you "Karma Points" which indicated your level of parking generosity. While a primitive method — albeit, with a tech savvy approach — for locating parking spaces, it symbolizes that the parking public is looking for easier methods to find open spaces and reduce cruising.

Newer and more advanced applications that use either parking operator back end data or in-street sensors are able to actually provide real-time occupancy information and location of available spaces. These applications are relatively new and are being marketed as a solution for cruising and delay related to hunting for that last on-street space. These applications also let you pay for parking, and just like the pay-by-cell phone method, will provide you notifications when you are about to exceed your time and allow you to add time up to the regulated limit.

BENEFITS OF CELL PHONE BASED PARKING SOLUTION

The previous sections described some of the newest technologies available for the implementation of paid on-street parking. The on-street parking revenue control industry has evolved considerably in the past 77 years, since the first meter was installed in Oklahoma City. The meters of that era used coin operation, twist dials to engage, and visible flags to indicate whether parking was in violation or not. That type of meter was in place for 40+ years, until a digital model was developed, which replaced mechanical parts with electronic components. Then in the late 1990s, the industry took a turn into the technological revolution and began to evolve at a rapid pace, introducing multi-space meters, in-car metering, in-space sensors, cell phone payment systems, and today's most recent evolution, the single space credit card meter.

Looking at recent trends, the industry is definitely moving at a rapid pace, and the technologies that are new today could very well be outdated within a few years. With that in mind, it is prudent to look forward to see the next iteration of solutions to ensure implementations and capital investments are targeted wisely. When looking at other communities throughout the country or other countries throughout the world, the one trend that seems to be catching on quicker than others is the move to mobile payment technologies.

Many cities throughout Europe and the Middle East have moved to a pure pay-by-phone parking environment in the past 5 years, reducing their capital expenditure and increasing access for customers. Within the past year, several communities in the U.S. have begun to experiment with this type of system, implementing pilot areas to measure acceptance and potential for revenue offsets.

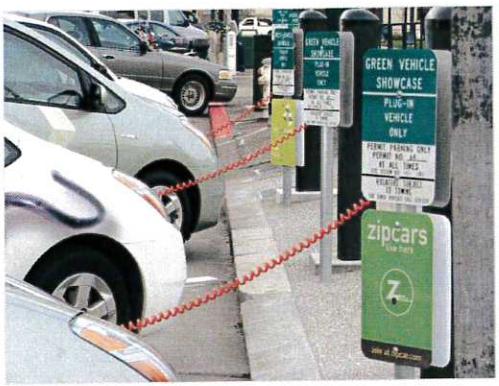
The initial reluctance to institute a pay-by-phone only system was the perception that the system would not be equitable. More directly, how would those citizens without cell phones pay for their parking? Well as cell phones become a more integrated part of society, that fear is dwindling. According to research by the Pew Research Center, 88% of Americans own a cell phone. Even more important, 46% of Americans own a smartphone and use their cellular devices for more than phone calls, a trend that is escalating quickly (with another estimated 10% bump by the end of next year).

With these statistics and the continued evolution of the cell phone, is it any surprise that pay-by-phone payment methodologies are popping up in communities everywhere? Pay-by-phone is not a new concept, but its acceptance is at an all-time high. And for the first time since its introduction in the U.S., we are starting to see communities consider all Pay-By-Cell systems. Think about some of the benefits:

- The user pays an overwhelming majority of capital and maintenance costs – the only equipment needed is the user's cell phone
- The user only pays for the time that they park – the transaction is engaged at the beginning and can be disengaged when completed
- The user can get notifications before they go over time, allowing for remote addition of time or advanced notification prior to violation
- Integration of smartphone applications allows for wayfinding, payment, management, enforcement, and communications all through the user's smartphone
- Most systems have robust back-end management systems that can provide advanced management of the parking system
- Transaction and gateway costs (sometimes as high as $0.16 per transaction with traditional meters) are negated or passed on to the consumer

[1] http://pewinternet.org/Reports/2012/Smartphone-Update-2012/Findings.aspx

Electric Vehicle Charging Stations



The City has a goal to "encourage the use of plug-in electric vehicles in Durham as a substitute for petroleum powered vehicles to help achieve community-wide quality of life and greenhouse gas emissions reduction goals".[6] As of the issue date of the *Durham City-County Electric Vehicle and Charging Station Plan* (December 2011), there were fourteen total EV charging stations installed, or currently planned, within the City, with goals to continually increase the number of stations throughout the upcoming years. The *Durham City-County Electric Vehicle and Charging Station Plan* outlines design standards and characteristics, as well as several priority locations for future charging station installations, many of which would require retrofit within existing facilities. Installation of charging stations within existing facilities will result in higher installation costs per space, as the infrastructure for the station will be required to adapt to the site condition, rather than programming the station into the original design of the facility.

As the City begins to implement charging stations, specific planning and thought needs to be given to time limits, parking charges, and vehicle restrictions. Initially, the use of this technology may be low and the City may be able to operate the spaces like any others within the downtown. However, as demand for these spaces increases, the City will need to restrict usage to electric vehicles that are charging only. Enforcement of these spaces should include a fine high enough to deter regular vehicles from parking in the space ($50.00 per citation, for example).

If the City installs charging stations serving on-street spaces, they may need to address time restrictions to allow for sustained charging operations. However, the City should not allow unregulated parking by charging vehicles, as some parkers will take advantage of the service. The City should work with the charging station vendors to identify appropriate time limits that allow for suitable charging without losing the space to a lone charging vehicle for an extended period. As with all other spaces, electric vehicle charging spaces should be subject to peak hour restrictions and associated fines and towing.

As the vehicle charging station industry continues to advance, the City should periodically review technological advances and adjust the City-County Plan as appropriate. No matter the quantity and location of vehicle charging station installations, the following policies are recommended to be applied to the use of these dedicated spaces:

- Users of an electrical vehicle charging station space should be required to pay for the use of the space in a manner that is consistent with the facility in which it is located.
- Electric vehicle charging station spaces should be reserved for electric vehicle use only. Use of this space by non-electric vehicles should be ticketed.

[6] Durham City-County Electric Vehicle and Charging Station Plan, December 2011

- Use of an electric vehicle charging station space should be time restricted, to minimize the situation of one vehicle occupying the space for an entire day. The time limit should be determined on a case by case basis and be based on the charging duration requirements of the equipment being installed.

Finally, the City should develop a graphic to be included on the City website, specifically the Parking page, which locates the publicly available electric vehicle charging stations within the City. As the City continues to grow its electric charging vehicle station inventory, this graphic should be updated such that maximum utilization of installed charging stations is achieved.